

HUMAN SPACE FLIGHT
FISCAL YEAR 2002 ESTIMATES
BUDGET SUMMARY

OFFICE OF SPACE FLIGHT

PAYLOAD UTILIZATION AND OPERATIONS

SUMMARY OF RESOURCES REQUIREMENTS

	FY 2000 OPLAN <u>REVISED</u>	FY 2001 OPLAN <u>REVISED</u>	FY 2002 PRES <u>BUDGET</u>	Page <u>Number</u>
	(Thousands of Dollars)			
Payload carriers and support.....	49,300	[56,875]	[57,000]	HSF 3-3
Expendable launch vehicle mission support.....	30,600	[33,127]	[34,300]	HSF 3-5
Engineering and technical base	85,200	[73,338]	[75,200]	HSF 3-7
OSF Contributions to Academic Programs (in ETB).....	<u>(2,300)</u>			
Total.....	<u>165,100</u>	<u>[163,340]</u>	<u>[166,500]</u>	
<u>Distribution of Program Amount by Installation</u>				
Johnson Space Center	27,171	[27,300]	[29,000]	
Kennedy Space Center	77,460	[86,102]	[86,774]	
Marshall Space Flight Center	44,779	[37,500]	[37,826]	
Stennis Space Center	1,586	[--]	[--]	
Ames Research Center	960	[--]	[--]	
Glenn Research Center	489	[--]	[--]	
Langley Research Center	900	[--]	[--]	
Goddard Space Flight Center.....	9,900	[10,900]	[11,400]	
Jet Propulsion Laboratory	635	[--]	[--]	
Headquarters	<u>1,220</u>	<u>[1,538]</u>	<u>[1,500]</u>	
Total.....	<u>165,100</u>	<u>[163,340]</u>	<u>[166,500]</u>	

Note -- Beginning in FY 2001, the Payload Utilization and Operations Budget Line Item (BLI) was been divided into two new budget line items - Payload and ELV Support and Investments and Support. Payload carriers and support and ELV Mission Support move to the Payload and ELV support BLI, while Engineering and Technical Base moves to the Investments and Support BLI. FY 2001 and FY 2002 data in this section are for comparison purposes only. See Payload and ELV Support and Investment and Support for more details.

PROGRAM GOALS

There are several goals in the Payload Utilization and Operations budget. They range from supporting the processing and flight of Space Shuttle payloads and NASA payloads launched from Expendable Launch Vehicles (ELV), to ensuring maximum return on the research investment, to reducing operations costs, to continuing to implement flight and ground systems improvements, and to supporting strategic investments in advanced technology needed to meet future requirements.

STRATEGY FOR ACHIEVING GOALS

The principal areas of activity in the Payload Utilization and Operations program are: 1) provide safe and efficient payload preparations and launch and landing services while reducing costs of Space Shuttle-related services; 2) provide mission planning, integration and processing for science application missions utilizing –the Multiple-Purpose Experiment Support Structures (MPRESS) and payload pallets; 3) within Advanced Projects, identify and develop advanced technology to support Shuttle, International Space Station (ISS) and future Human Exploration and Development of Space programs to improve safety and reduce costs, promote space commercialization and technology transfer, and manage the agency's Orbital Debris program; and 4) within Engineering and Technical Base (ETB), empower a core workforce to operate Human Space Flight laboratories, technical facilities, and test beds, and stimulate science and technical competence in the United States. The Payload Utilization and Operations budget reflects a commitment to meet a wide array of programs. This includes Space Shuttle and science missions, flight hardware development and integration, space flight safety projects, and maintenance of an institutional base from which to perform NASA programs at reduced cost through re-engineering, consolidation and operational efficiency processes. Beginning in FY 1999, Expendable Launch Vehicle (ELV) mission support was consolidated and transferred from Earth Science and Space Science to provide more focused and efficient management of launch services to be located at the Kennedy Space Center and Cape Canaveral Air Force Base in Florida.

Beginning in FY 2001, the Payload Utilization and Operations Budget Line Item (BLI) was divided into two new budget line items - Payload and ELV Support and Investments and Support. Payload carriers and support and ELV Mission Support move to the Payload and ELV support BLI, while Engineering and Technical Base moves to the Investments and Support BLI.

BASIS OF FY 2002 FUNDING REQUIREMENT

PAYLOAD CARRIERS AND SUPPORT

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Payload Carriers and Support	49,300	[56,875]	[57,000]

PROGRAM GOALS

The primary goal for Payload Carriers and Support is to safely and efficiently assemble, test, checkout, service, and integrate a wide variety of spacecraft and space experiments launched on the Space Shuttle.

STRATEGY FOR ACHIEVING GOALS

The Payload Carriers and Support program provides the technical expertise, facilities and capabilities necessary to perform payload buildup; test and checkout; integration and servicing of multiple payloads; transportation to the launch vehicle; integration and installation into the launch vehicle; post-landing retrieval, and de-integration of payloads. Operational efficiencies have been achieved that reduced processing time and error rate. Additional efficiencies under development are anticipated to further reduce cost and improve customer satisfaction.

Payload Carriers and Support also funds smaller secondary payloads like the Get-Away Specials (GAS) and Hitchhiker payloads that are managed at Goddard Space Flight Center (GSFC). The GAS payloads are research experiments that are flown in standard canisters, which can fit either on the sidewall of the cargo bay or across the bay on the GAS bridge. They are the simplest of the small payloads with limited electrical and mechanical interfaces. Approximately 158 GAS payloads have been flown. The Hitchhiker payloads are the more complex of the smaller payloads, and provide opportunities for larger, more sophisticated experiments. The Hitchhiker system employs two carrier configurations: (1) a configuration on the Orbiter payload bay sidewall and (2) a configuration across the payload bay using a Multi-Purpose Experiment Support Structure (MPESS). During the mission, the Hitchhiker payloads can be controlled and data can be received using the aft flight deck computer/standard switch panels or from the ground through the Payload Operations Control Center (POCC).

Payload analytical integration is the responsibility of the Flight Projects Directorate at the Marshall Space Flight Center (MSFC), supported by a contract with Boeing. Physical payload integration and processing is the responsibility of the Space Station and Shuttle Payloads Directorate at the KSC, also supported by a contract with Boeing.

Another item funded in Payload Carriers and Support is the Flight Support System (FSS) at the Goddard Space Flight Center. The FSS consists of three standard cradles with berthing and pointing systems along with avionics. It is used for on-orbit maintenance, repair, and retrieval of spacecraft. The FSS is used on the Hubble Space Telescope (HST) repair/revisit missions.

SCHEDULES AND OUTPUTS

	FY 2000		FY 2001		FY 2002
	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Revised</u>	<u>Plan</u>
<u>Missions Supported</u>					
Space Shuttle Missions	6	4	[9]	[7]	[7]
Hitchhiker Experiments, includes CAP/SEM/HH Jr.	2	3	[7]	[6]	[2]
Get-Away Special Payloads	--	1	[2]	[2]	[8]
Spacehab Missions	1	2	[1]	[1]	[--]
Other Major Payloads	11	4	[13]	[20]	[13]
Other Secondary Payloads	6	8	[1]	[8]	[2]
Multi-Purpose Experiment Support Structure (MPRESS)					
Pallets	3	3	[5]	4]	[3]
<u>Number of Payload Facilities Operating at KSC</u>	5	5	[5]	[6]	[5]
<u>KSC Payload Ground Operations (PGOC) Workforce</u>	308	258	[334]	[302]	[322]

ACCOMPLISHMENTS AND PLANS

During FY 2000, Payload Carriers and Support provided the FSS and a pallet, integration and testing support activities for Hubble Space Telescope (HST) Servicing Mission 3A, a pallet, integration and testing support activities in support of the Shuttle Radar Topography Mission (STRM), and a pallet in preparation for one ISS assembly flight. Launch and landing payload support activities were provided for four Space Shuttle missions, encompassing payload processing support activities and facilities for six major payloads, including two ISS assembly and utilization flights. A number of secondary payloads were also supported. Funding also included the planning and processing of payloads in support of the Space Shuttle and ELV manifests; and provided operations and maintenance (O&M) of five Payload Facilities at KSC. In order to fund the requirements of payload processing for the HST Servicing Mission added in FY 2000, NASA has placed the Vertical Processing Facility (VPF) at KSC in a stand-by mode. While there are no current requirements in the Shuttle manifest for the unique capabilities of the VPF, the VPF is the only vertical integration facility for Shuttle payloads as well as the only location with hazardous Cargo Integration Test Equipment (CITE) capabilities. This could have potential impact on processing some payloads due to conflicts in remaining facilities. Reimbursable funds of \$1,125,000 were received in FY 2000 to cover processing costs for GAS and Hitchhiker payloads.

Beginning in FY 2001, the Payload Carriers and Support budget was transferred to a new budget line item called Payload and ELV Support. Details on FY 2001 and FY 2002 activity can be found in this section.

BASIS OF FY 2002 FUNDING REQUIREMENT

EXPENDABLE LAUNCH VEHICLE SUPPORT

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Expendable Launch Vehicle Support	30,600	[33,127]	[34,300]

PROGRAM GOALS

The goals of the Expendable Launch Vehicle (ELV) mission support program are: (1) enhance probability of mission success and on-time cost effective launch services for NASA missions undertaken in support of NASA's strategic plan; (2) provide comprehensive advanced mission analysis and feasibility assessments for NASA payload customers; (3) increase efficiency in launch site operations and countdown management; and (4) provide low-cost secondary payload opportunities.

STRATEGY FOR ACHIEVING GOALS

NASA has consolidated ELV management and acquisition of launch services at Kennedy Space Center (KSC). Effective in FY 1999, all funding for mission support was transitioned from the Office of Space Science and the Office of Earth Science to the Office of Space Flight, consistent with assignment of responsibility for ELV management to OSF.

KSC is responsible for acquiring requisite launch services to meet all Enterprise requirements and for increasing the probability of mission success through focused technical oversight of commercially provided launch services. A core team of civil servants and contractors primarily located at KSC performs the technical management. KSC personnel are also resident at key launch sites, launch facilities and customer facilities. NASA personnel are resident at Vandenberg AFB in California where all launches into a polar orbit, such as those required by the Earth Science Enterprise, are conducted. Resident office personnel are located in launch service contractor plants, specifically, the Lockheed Martin Corporation Atlas Centaur plant in Denver and the Boeing Corporation Delta plant in Huntington Beach, California. KSC customer offices have been established at GSFC and JPL as the centers assigned program management responsibility for the majority of Space Science and Earth Science missions requiring access to space via NASA-provided launch services.

Advanced mission design/analysis and leading edge integration services are provided for the full range of NASA missions under consideration for launch on ELV's. Technical launch vehicle support is provided in the development and evaluation of spacecraft Announcement of Opportunities, to enable cost effective consideration of launch service options and technical compatibility. Early definition of vehicle requirements enables smooth transition to launch service and an excellent cost containment strategy.

Launch site operations and countdown management is being improved through the use of a consolidated launch team, efficient telemetry systems, and close partnership with Boeing and the USAF to assure lowest cost west coast Delta launch complex operations.

NASA's ELV secondary payload program enables efficient use of excess vehicle performance on selected NASA, USAF and commercial missions through funding integration of small secondary payloads. These payloads are sponsored by university research institutions and often international cooperatives which can take advantage of available limited excess space and performance on launch vehicles and accept the primary payload's launch schedule and orbit. NASA has developed a standard Delta secondary launch vehicle capability and has similar discussions under way with other US ELV providers.

SCHEDULES AND OUTPUTS

	<u>FY 2000</u>		<u>FY 2001</u>		<u>FY 2002</u>
<u>Missions Supported</u>	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Revised</u>	<u>Plan</u>
Primary ELV Missions	9	6	[11]	[10]	[8]
Secondary ELV Payloads	5	1	[1]	[2]	[1]
Total Missions Supported	14	7	[12]	[12]	[9]

ACCOMPLISHMENTS AND PLANS

During FY 2000, six ELVs were successfully launched (SWAS, Deepspace, Mars Orbiter, Mars Lander, Stardust, Landsat 7, FUSE, WIRE, Terriers, QuikScat) and three were delayed by contractor failure investigation activities until FY 2001 (TDRS-H, TERRA, and GOES-L). One secondary payload was launched (ORSTED/SUNSAT) and two secondaries (Munin/CE) were delayed due to the readiness of the primary spacecraft. The modification/rehabilitation project of the Engineering and Operations Building located on Cape Canaveral Air Station, Florida, was completed. Installation of a backup power supply system located at Vandenberg Launch Site Complex 2 (SLC-2) at Vandenberg Air Force Base (VAFB), California, was also completed.

In FY 2000, the NASA Launch Services (NLS) procurement for purchasing launch services for future NASA missions – including potential Space Station re-supply missions was competed. This contract provided for awards to multiple contractors with vehicles with demonstrated flight history.

Beginning in FY 2001, the ELV Mission Support budget will be in a new budget line item called Payload and ELV Support. Details on FY 2001 and FY 2002 activity can be found in this section.

BASIS OF FY 2002 FUNDING REQUIREMENT

ENGINEERING AND TECHNICAL BASE

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Engineering and technical base	85,200	[73,338]	[75,200]

PROGRAM GOALS

The focus of the Engineering and Technical Base (ETB) is to support the institutional capability in the operation of space flight laboratories, technical facilities, and testbeds; to conduct independent safety, and reliability assessments; and to stimulate science and technical competence in the United States. ETB activities are carried out at the Johnson Space Center (JSC) including White Sands Test Facility (WSTF), Kennedy Space Center (KSC), Marshall Space Flight Center (MSFC), and Stennis Space Center (SSC). ETB funds are used to: maintain the Centers' technical competence and ability to perform research; conduct analysis and testing tasks; solve present problems; and to reduce costs in developing programs, technologies, and materials. Efforts include system and mission analysis, integrated HSF Research and Technology (R&T) requirements definition and integration, modest R&T investments in an EVA technology demonstration project and investments in R&T required for supporting the integrated Office of Space Science/HEDS robotic efforts.

STRATEGY FOR ACHIEVING GOALS

The complex and technically challenging programs managed by the Office of Space Flight (OSF), now and in the future, are most effectively carried out by sustaining a NASA "core" institutional technical base. It is vital to preserve essential competency and excellence. Since FY 1994, the OSF centers have consolidated activities and have identified ways to economize the resources committed to ETB while maintaining ETB's benefits to the nation's human space flight program. Over the next few years, this consolidation will continue to generate savings through improved information resources management and contract streamlining. A prioritized core capability will include multi-program labs and test facilities, associated systems, equipment, and a full range of skills capable of meeting research, testing and simulation demands.

As the ETB budget is reduced, several activities will continue to refine current business practices. Mandatory equipment repair and replacement will be reassessed. Software applications for multi-program analytical tools will be implemented. The strategy to better manage the NASA investment in information processing resources includes aggressive actions to integrate and consolidate more ADP operations. ETB will ensure synergism among major NASA engineering programs. Awards for education and research tasks will be granted to support educational excellence and research learning opportunities in colleges and universities. A key challenge of the ETB strategy will be to provide a core capability for future human space flight endeavors with fewer resources. Adoption of new innovative processes to meet critical ETB core requirements and streamlining or eliminating non-critical capabilities will enable future savings.

In the FY 2001 budget, funding for Engineering and Technical Base was moved from the Payload Utilization and Operations budget line item to a new budget line item, Investments and Support.

SCHEDULES AND OUTPUTS

Laboratories & facilities supported (KSC)	Maintains 11 science and engineering laboratories in support of 6 agency programs
Laboratories & facilities supported (JSC)	Maintains 156 science and engineering laboratories in support of 52 agency programs
Laboratories & facilities supported (MSFC)	Maintains 123 science and engineering laboratories and facilities in support of 42 agency programs
Laboratories & facilities supported (SSC)	Maintains 3 science and engineering laboratories in support of 2 agency programs
NASA Minority University Research and Education Program at JSC, KSC, MSFC & SSC	Award education and research grants

ACCOMPLISHMENTS AND PLANS

In FY 2000, ETB continued to provide vital support to JSC, KSC, SSC, and MSFC science and engineering lab infrastructure to meet many critical programmatic milestones that require extensive support from these labs. NASA performed many critical studies, tests, and analyses for many activities. These included: monitoring human life support and crew health as crews begin to inhabit the International Space Station; ensuring the Space Shuttle can safely operate and transport Station hardware and astronaut personnel; and ensuring smooth and safe operations of personnel and equipment during the Station assembly EVAs. In addition, ETB will keep our labs operational to perform exploration and development studies.

The Engineering and Technical Base also supports Information Resource Management (IRM). IRM processing achieved efficiencies and improved economies of scale through the consolidation of IBM-compatible mainframes supporting administrative and programmatic automated data processing (ADP) services at the NASA ADP Consolidation Center (NACC) located at MSFC. The NACC continues to seek new and innovative ways to achieve cost savings. Since 1994, the NACC has provided supercomputing capability for its customers for engineering and scientific computer-intensive applications seven days a week. The NACC supercomputing facility includes a mainframe located at MSFC and a smaller distributed system located at JSC, supporting customers at both Centers. The NACC supercomputer facilities include hardware and software to conduct thermal radiation analyses, computational

fluid dynamics, structural dynamics and stress analyses for NASA programs such as the Space Shuttle, X-33, X-34, Space Station, and Reusable Launch Vehicle. The facilities also conduct certification and engineering performance evaluation of flight and test data.

In FY 2000, there was an effort to include systems analysis and modest investments in research and technology to meet long-term HSF requirements included in the ETB budget. The In-House HEDS Studies for FY2000 addressed systems definition and analysis, and technology road map definition for a wide variety of potential options for future HEDS programs to improve safety and reduce costs; to promote space commercialization and technology transfer; and to enable future missions. These studies were closely integrated with agency next decade planning activities and the HEDS Technology/Commercialization initiative started in FY 2001. Systems Analysis will provide for overall planning and analysis for development of new technology, focusing on innovative, high-leverage technologies and approaches which will enable the development of new capabilities to meet future human space flight needs, and providing the opportunity for enhanced synergy between ongoing programs and future HEDS objectives. Studies included the following activities:

- Overall integration and development of technical requirements, technology roadmaps, and investment strategies;
- Evaluation of alternative mission approaches and technologies;
- Development of advanced transportation system architectures and technology requirements;
- Definition of R&T for Advanced Power, Information Systems Technology, and Advanced Sensors;
- System & concept definition and identification of proof-of-concept tests/ demonstrations for key emerging HEDS technologies/systems;
- ISS evolution systems analysis to determine far-term mission requirements and concepts for cost reduction and performance enhancement; and
- Identification of candidate HEDS payloads for future Mars robotics missions providing low cost environmental data and technology demonstrations that are necessary to enable safe exploration missions in the future.

In FY 2000, ETB continued to provide vital support to JSC science and engineering lab infrastructure. FY 2000 contained many critical programmatic milestones that required extensive support from our labs. NASA performed many critical studies, tests, and analyses for many activities. These included: monitoring human life support and crew health as we inhabited Station in FY 2000; and ensuring the Shuttle could safely operate and transport Station hardware and astronaut personnel; ensuring smooth and safe operations of personnel and equipment during the Station assembly EVAs. In addition, ETB kept our labs operational to perform exploration and development studies.

In cooperation with the goals of the NASA Minority University Research and Education Program, ETB enabled the Space Flight Centers to participate in programs to stimulate science and technical competence in the nation. The ETB program enabled the Centers to award education and research grants to Historically Black Colleges and Universities (HBCU). Examples include: solution crystal growth in low gravity; organic fiber optic sensors; hydrology, soil climatology, and remote sensing; and cytogenic investigations into radiosensitivity, genetic instability and neoplasty. JSC awarded approximately \$1.0 million in new research grants to Historically Black Colleges and Universities and Other Minority Universities. MSFC, KSC and SSC also participated in programs to stimulate science and technical competence by participating in education and research grants with Historically Black

Colleges and Universities (HBCU) and Other Minority Universities (OMUs). Beginning in FY 2001. This activity was removed from the ETB program and consolidated with other Office of Space Flight contributions to academic programs in a single project.

In FY 2000 the ETB budget continued to implement the Agency's Zero-Base Review (ZBR) recommendations. These include a reduced level of science and engineering lab support to human space flight programs, streamlined technical operations, additional ADP consolidation activities, and reduced education and research awards funding. These reductions required that all Centers continue to assess their range of workforce skills, analytical tools and facilities dedicated to ensure their ability to provide space flight institutional engineering support for future human space flight programs and the existing customer base. Center assessments focused on maintaining core support for design, development, test and evaluations, independent assessments, simulation, operations support, anomaly resolution, and systems engineering activities.

Beginning in FY 2001, the Engineering and Technical Base budget was moved to a new budget line item called Investments and Support. Details on FY 2001 and FY 2002 activity can be found in this section.